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MOUTHPARTS OF AUSTRALIAN *CORETHRELLA* (DIPTERA: CORETHRELLIDAE), WITH A REPORT OF A NONBITING SPECIES

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Abstract.—Female *Corethrella marksae* from Hinchinbrook Island and *C.* sp. near *urumense* from Darwin, Australia, have biting mouthparts similar to those reported from other biogeographic regions. They are more membranous than those of North American species and, for this reason, may be nonfunctional. Female specimens of an undescribed form from Hinchinbrook Island have mouthparts without teeth that superficially resemble those of male *C. appendiculata* and *C. wirthi*; they are described and illustrated with SEM photomicrographs. This is the first report of *Corethrella* with toothless mouthparts.

Key Words: Diptera, *Corethrella,* mouthparts

Seven families of Diptera were listed by Downes (1958) as biting flies, i.e. those in which females have mandibulate mouthparts adapted for penetrating the integument and ingesting body fluids of a host. These families include Blepharoceridae, Psychodidae, Ceratopogonidae, Simuliidae, Culicidae, Tabanidae, and Rhagionidae. Subsequently, some species of Tanyderidae were found to have mandibles with teeth; and specimens of an undescribed species of Chironomidae, commonly known as the nonbiting midges, were found to have strongly sclerotized mandibles with large teeth similar to those of entomophagus Ceratopogonidae (Downes and Colless 1967). The chironomid was later described as *Archaeochlus brundini* (Cranston et al. 1987). An additional family, the tenth, was added to the biting fly group by erection of the family Corethrellidae (Wood and Borkent 1989) whose members previously had been classified as a subfamily of Chaoboridae (Saether 1970). In addition to having highly sclerotized, toothed mandibles, most members of each of the foregoing families have the hypopharynx, laciniae and labrum sclerotized to varying degrees; one or all of these structures may be toothed.

Some species and genera of all of the first nine families listed in the foregoing have been reported to have mouthparts that are reduced in size and/or armature (Downes 1958, Downes and Colless 1967). *Corethrella* Coquillett with toothed mouthparts have been reported from all biogeographic regions of the world except the Australian (Miyagi 1975, McKeever and Pound 1979, Cranston 1980), but to date none has been reported with toothless mouthparts. We examined *Corethrella* from Australia and here report that the two described species (Col-

less 1986) have toothed mouthparts, but specimens of an undescribed species were found to have toothless mouthparts.

Materials and Methods

Specimens of *Corethrella* were collected 8–17 November 1984 at Hinchinbrook Island (Cayundah Creek), Queensland and July 1958 at Darwin, Northern Territory and preserved in 70% ethanol. Methods of preparation of mouthparts for study follow McKeever (1986).

Results

Toothed mouthparts were found on one specimen, designated *Corethrella* sp. near *C. urumense* Miyagi, from Darwin and on one specimen, designated *C.* sp. near *C. marksae* Collett, "Cooktown form," from Hinchinbrook Island. Mandibles, lacinae and labrum were not observed on the former specimen, but its hypopharynx has 20 teeth, longest 1.3 μm, along each side, length of tooth row 59.8 μm (Fig. 1). The latter specimen has mandibles with fine teeth, number not determined; a hypopharynx with 14 teeth per side, longest 1.3 μm, length of tooth row 49.2 (Fig. 2) and laciniae with 6 spicules at the tip, none on edges or sides (Fig. 3). All three structures are sclerotized, but much thinner and more membranous than those of North American species.

Two additional female specimens, A and B, from Hinchinbrook Island represent an undescribed species with toothless mouthparts. Mandibles are 66.5–75.8 μm long, 18.6 wide, poorly sclerotized, with 6 minor undulations rather than teeth on the distolateral margin (Fig. 4, specimen A). The hypopharynx is lightly sclerotized, 14 coarse spicules per side rather than teeth, longest one 13.3 μm. Length of hypopharynx from base of proximal spicule to tip 42.5 and 43.9 μm, tip blunt with short spicules, width at base of proximal spicule 23.9 and 23.9 μm (Fig. 5, specimen A; Fig. 6, specimen B). Laciniae have spicules at the tip only.

Discussion

Mouthparts of female *Corethrella* that have been illustrated elsewhere show the mandibles and hypopharynx to be toothed, the labrum terminating in two sclerotized peg-like structures, and the laciniae to be poorly sclerotized, toothless blades with spicules over the entire medial and lateral surfaces (Miyagi 1975, Cranston 1980, McKeever 1986). In contrast, the toothless mandibles, hypopharynx, and laciniae of the two females from Hinchinbrook Island superficially resemble those of male *C. appendiculata* Grabham and *C. wirthi* Stone (McKeever 1986), but differ from them in the following particulars: the mandibles of females have no spicules, whereas those of males have spicules at the tip; spicules on the edge and tip of the hypopharynx of females are fewer, stouter and shorter than those of males; and the laciniae of females have fewer spicules than those of males.

Female *Corethrella* with toothless mouthparts are nonbiting and, therefore, autogenous. Those with armored mouthparts are assumed to be hematophagous, and four species have been found either with blood in the digestive tract [*C. japonicum* Miyagi (Miyagi 1975) and *C. buettikeri* Cranston (Cranston 1980)], or observed feeding [*C. brakeleyi* (Coquillett) and *C. wirthi* (McKeever and Pound 1979)]. Hematophagous species may also be autogenous, e.g. *C. appendiculata* is autogenous and has

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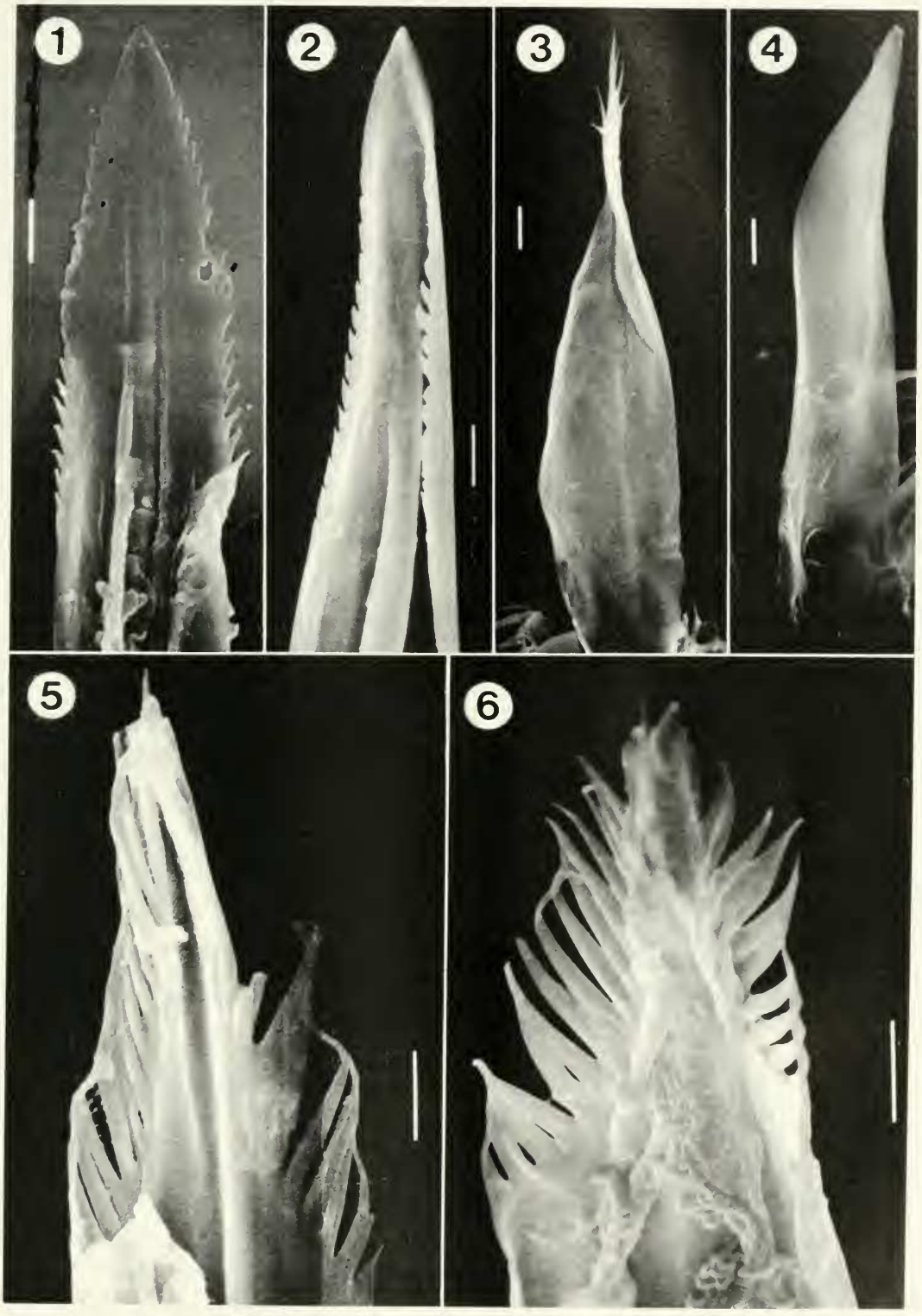
Figs. 1–6. SEM photomicrographs of mouthparts of female *Corethrella* from Australia. 1. Hypopharynx of *C.* sp. near *urumense*, ventral view. 2. Hypopharynx of *C.* sp. near *marksae*, dorsal view. 3. Lacinia of *C.* sp. near *marksae*. 4. Mandible of *C.* sp., specimen A. 5. Hypopharynx of *C.* sp., specimen A, dorsal view. 6. Hypopharynx of *C.* sp., specimen B, ventral view. White lines equal 8 μm.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been colonized (McKeever 1985). However, adult *C. wirthi* raised from eggs laid by females that had obtained a blood meal in the wild and maintained under conditions identical to those for *C. appendiculata* failed to reproduce. To our knowledge, no one has attempted to colonize other known hematophagous species, so whether or not they are autogenous is unknown. Presumably, *C. appendiculata* and any other autogenous species with toothed mouthparts would, if they obtain subsequent blood meals after the autogenous first cycle, undergo one or more additional gonotrophic cycles.

Downes (1971) suggests that, since blood-sucking flies have a somewhat uniform proboscis with blade-like, apically toothed mandibles, the ancestral Diptera were biting flies and nonbiting that occurs in all families is a secondary characteristic. He further states that the typical proboscis of biting forms is readily subject to reduction, with the mandibles being the most sensitive elements. In such cases, mandibles become reduced in size and degree of sclerotizaiton, and the teeth are reduced to bristles or lost entirely. Reduction and/or loss of armature of the mouthparts must be accompanied by development of the process of autogeny, although many autogenous species and genera in all families retain the blood sucking habit (Downes 1958). Autogeny enables both biting and nonbiting species to exist beyond the ecological range of nonautogenous biting species, e.g. where hosts are difficult to find or in cold windy environments, and has occurred in all periods of history (Downes 1971).

The two named species of Australian *Corethrella* probably are obligate autogenous forms. Even though they have toothed mouthparts, the structures may be too flexible and membranous to penetrate a host. North American species with heavier, more rigid mandibles require several minutes to penetrate the skin of tree frogs (*Hyla*) (pers. obs.). Thus, all Australian forms would be capable of only the autogenous ovarian cycle and the species with toothed mouthparts would not have a competitive advantage. Conditions that led to development of the form with toothless mouthparts, specimens A and B, are unknown. However, the fact that it now coexists with the toothed form, *C.* sp. near *C. marksae* "Cooktown form," on Hinchinbrook Island indicates that it could successfully compete elsewhere, and additional collecting will undoubtedly show it to be more widely distributed.

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